UDC 666.3.022.66:666.64

EFFECT OF DULAPIX Ca THINNING AGENT ON THE RHEOLOGICAL PROPERTIES OF MAJOLICA SLIP

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Translated from *Steklo i Keramika*, No. 9, pp. 11 – 12, September, 2007.

The use of a nontraditional electrolyte, DULAPIX Ca, in thinning of majolica paste allows reducing the moisture content of the slip. The degree of the decrease in the moisture content of the slip is a function of the hardness of the water: the higher the hardness, the greater the content of the electrolyte in the slip. For this reason, the hardness of the water must be monitored and softened water must be used in production of majolica slip.

In any ceramics factory, reducing the moisture content of the slip in casting articles is a major problem.

In thinning majolica paste, we investigated the behavior of the slip with different thinning agents, including a nontraditional electrolyte, DULAPIX Ca, used for the first time in fabrication of majolica slip.

DULAPIX Ca is an organic, nonfoaming, alkali-free thinning agent. With respect to the external appearance, it is a yellowish liquid which turns brown when exposed to light. The content of active substance in DULAPIX Ca electrolyte is approximately 25%, and it mixes easily with water, forming a solution with a pH of 9. The thinning effect of this additive is manifested immediately after it is incorporated in the slip, which allows adjusting its viscosity due to rapid homogenization.

The thinning effect of DULAPIX Ca is due to the electrochemical effect of the functional groups in the additive on the surface of the clay particles. The clay particles included in the polymer shielding shell reduce the viscosity of the slip.

The rheological properties of majolica slip containing DULAPIX Ca electrolyte were investigated in different conditions, namely, by varying the hardness of the water from 6.5 to 12 meq/liter and the density of DULAPIX Ca (1.1, 1.2, and 1.3 g/cm^3) during thinning of majolica paste prepared from Gzhel clay.

We found that the character of thinning of majolica paste containing DULAPIX Ca electrolyte changed if the hardness of the water was increased from 6.5 to 12 meq/liter. The slip became unstable. Slip containing DULAPIX Ca within the limits of 0.076 – 0.23% at density of 1.3 g/cm^3 and at a 0.057 – 0.25% electrolyte content and density of 1.1 g/cm^3 exhibited the greatest tendency toward thixotropy (see Fig. 1). In addition, slip with a DULAPIX Ca density of 1.2 g/cm^3 was characterized by the lowest thixotropy, and its content in the slip reached 0.0765 – 0.23%.

Thinning of majolica slip made from Gzhel clays with DULAPIX Ca electrolyte was more successful when water of low hardness was used. The system became unstable when the hardness of the water used in preparing the majolica slip increased. Regulation of the casting properties also became more complicated.

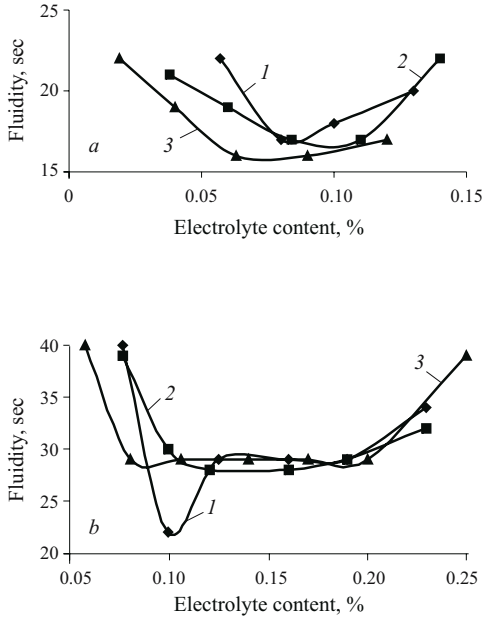

Fig. 1. Thinning of Gzhel clay with water with hardness of 6.5 meq/liter (*a*) and 12 meq/liter (*b*) with DULAPIX Ca electrolyte with density of 1.3 g/cm^3 (*1*), 1.2 g/cm^3 (*2*), and 1.1 g/cm^3 (*3*).

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TABLE 1

DULAPIX Ca electrolyte content in slip	Hardness of water, meq/liter	Thickening factor	Setting time of wall of article, min	Thickness of articles, mm	Casting defects
0.038	6.5	1.7	3	3.0	Cracks
			5	5.5	None
			7	6.0	″
0.060	6.5	1.6	3	1.0	Cracks
			5	3.0	″
			7	2.0	None
0.084	6.5	1.8	3	1.5	Cracks, deformation
			5	3.5	None
			7	5.3	Deformation
0.110	6.5	1.9	3	2.0	Cracks
			5	3.4	None
			7	5.2	″
0.140	6.5	1.5	3	0.5	Cracks, deformation
			5	1.0	Same
			7	1.5	″
0.076	12.0	3.3	3	5.0	Cracks
			5	5.4	None
			7	6.2	Cracks
0.099	12.0	4.0	3	4.0	″
			5	4.3	None
			7	5.5	″
0.120	12.0	3.4	3	2.5	″
			5	3.0	Cracks
			7	4.7	None
0.160	12.0	3.4	3	1.5	Cracks
			5	2.3	None
			7	5.2	″
0.190	12.0	3.4	3	1.5	Cracks, deformation
			5	1.8	Cracks
			7	2.3	Deformation
0.230	12.0	3.6	3	3.4	Cracks
			5	4.5	″
			7	6.0	″

The optimum density of DULAPIX Ca electrolyte used as a thinning agent for majolica slip was 1.1 and 1.2 g/cm^3.

Experimental majolica slip based on Gzhel' clays containing DULAPIX Ca electrolyte were characterized by the following casting properties: thickening factor of 1.7 – 3.4, different setting rate. In testing casting in industrial conditions, it was found that a defect such as the appearance of cracks in cast articles can occur in different stages of drying, while an increase in the hardness of the water inevitably makes it necessary to increase the content of DULAPIX Ca in the majolica slip, and its thickening factor increases. The results of testing majolica slip with DULAPIX Ca electrolyte with a 49% moisture content and 1.2 g/cm^3 density are reported in Table 1.

Incorporating DULAPIX Ca nontraditional electrolyte in majolica slip decreased its moisture content to 49%. We note that slip with traditional electrolytes (liquid glass and calcined soda) with a moisture content above 52% is used in production of majolica articles at Gzhel' Association CJSC.

The following conclusions can be drawn as a result of thinning dry-ground Gzhel' clay with water of 6.5 meq/liter hardness and DULAPIX Ca electrolyte of varying density:

changing the density of the DULAPIX Ca thinning agent intensifies coagulation of the slip, and the tendency of majolica slip toward thixotropy increases with an increase in the density of the electrolyte;

DULAPIX Ca nontraditional electrolyte with a density of 1.1 and 1.2 g/cm^3 is recommended for thinning majolica slip; a further increase in the density of the electrolyte will cause the abrupt development of thixotropic phenomena in the slip (see Fig. 1);

the content of DULAPIX Ca electrolyte in majolica slip is: 0.019 – 0.120% at density of 1.1 g/cm^3, 0.0138 – 0.140% at density of 1.2 g/cm^3, and 0.057 – 0.130% at density of 1.3 g/cm^3;

the optimum amount of DULAPIX Ca is 0.019 – 0.120% at a density of 1.1 g/cm^3; in this case, the widest possible thinning interval (see Fig. 1) is attained; an electrolyte content within the limits of 0.038 – 0.140% at a density of 1.2 g/cm^3 is also possible, but in a narrow thinning interval.

Slip prepared from Gzhel' clays with DULAPIX Ca electrolyte can thus be recommended in molding majolica articles by the casting method. However, in using this slip, it is necessary to monitor the hardness of the water used. The optimum thickening factors are 1.7 and 1.9 for water hardness up to 6.5 meq/liter and 3.4 and 4.0 for water hardness from 6.5 to 12 meq/liter.